CLAIMS:

1. In an optoelectronic timing system, an adaptive frequency generator system comprising:

5   at least one semiconductor laser configured to issue subnanosecond optical pulses defining a periodic pulse train;

at least a first optical waveguide, the waveguide configured to define a first time-quantifiable optical path

10   for a pulse of the train;

at least one additional optical waveguide, the additional waveguide configured to define a second time-quantifiable optical path for a pulse of the train different from the first waveguide;

15   a first nodal point coupled to the first and second waveguides at which pulses of the train are directed into the first and second waveguides;

a second nodal point coupled to the first and second waveguides at which pulses directed into the first and

20   second waveguides are recombined; and

wherein, the length of the second time-quantifiable optical path has a defined numerical relationship to the length of the first time-quantifiable optical path, such that the periodicity of pulses recombined at the second

25   nodal point has the same numerical relationship with the periodicity of the issued pulse train.

2. The system according to claim 1, wherein the at least one semiconductor laser is configured to provide a

30   pulsed output having a periodicity in the range of about 1 nanosecond so as to define a 1 gigahertz pulse train.

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3.   The system according to claim 2, wherein the second optical time-quantifiable optical path has a length differing from the first time-quantifiable optical path by about 0.5 nanoseconds, so as to define a 2 gigahertz pulse
5   train at the second nodal point.

4.   The system according to claim 1, further comprising:
a multiplicity of additional optical waveguides each
10   coupled to the first and second nodal points, the additional waveguides configured to define a multiplicity of time-quantifiable optical paths; and
wherein, the lengths of each of the multiplicity of additional time-quantifiable optical paths having a
15   numerical relationship with each other and with the first time-quantifiable optical path.

5.   The system according to claim 4, wherein the semiconductor laser is configured to provide a pulsed
20   output at a first periodicity and wherein the recombined pulse train at the second nodal point provides a pulse train having a second periodicity, the second periodicity being a multiple of the first, the multiple defined by the numerical relationship between the multiplicity of
25   additional time-quantifiable optical paths and the first time-quantifiable optical path.

6.   The system according to claim 5, wherein the semiconductor laser operates at a frequency of about 1
30   gigahertz.

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7. The system according to claim 6, wherein the lengths of the multiplicity of time-quantifiable optical paths differ from one another by about 0.2 nanoseconds, so as to define a 5 gigahertz pulse train at the second nodal point.

8. The system according to claim 7, wherein time quantification of the optical path length is defined by the distance required for a pulse to travel at the speed of light for a given time interval.

9. In an optoelectronic timing system, a method for adaptive frequency generation, comprising:

providing at least one semiconductor laser configured to issue subnanosecond optical pulses defining a periodic pulse train;

providing at least a first optical waveguide, the waveguide configured to define a first time-quantifiable optical path for a pulse of the train;

providing at least one additional optical waveguide, the additional waveguide configured to define a second time-quantifiable optical path for a pulse of the train different from the first waveguide;

directing pulses of the train into the first and second waveguides at a first nodal point;

recombining pulses of the train from the first and second waveguides at a second nodal point; and

configuring the lengths of the first and second time-quantifiable optical paths to have a defined numerical relationship to one another, such that the periodicity of pulses recombined at the second nodal point has the same

numerical relationship with the periodicity of the issued pulse train.

10. The method according to claim 9, wherein the at least one semiconductor laser is configured to provide a pulsed output having a periodicity in the range of about 1 nanosecond so as to define a 1 gigahertz pulse train.

11. The method according to claim 10, wherein the second optical time-quantifiable optical path has a length differing from the first time-quantifiable optical path by about 0.5 nanoseconds, so as to define a 2 gigahertz pulse train at the second nodal point.

12. The method according to claim 9, further comprising:
defining a multiplicity of additional optical waveguides each coupled to the first and second nodal points;
configuring the additional waveguides to define a multiplicity of time-quantifiable optical paths; and
wherein, the lengths of each of the multiplicity of additional time-quantifiable optical paths having a numerical relationship with each other and with the first time-quantifiable optical path.

13. The method according to claim 12, wherein the semiconductor laser is configured to provide a pulsed output at a first periodicity and wherein the recombined pulse train at the second nodal point provides a pulse train having a second periodicity, the second periodicity being a multiple of the first, the multiple defined by the

numerical relationship between the multiplicity of additional time-quantifiable optical paths and the first time-quantifiable optical path.

5   14. The method according to claim 13, wherein the semiconductor laser operates at a frequency of about 1 gigahertz.

       15. The method according to claim 14, wherein the
10 lengths of the multiplicity of time-quantifiable optical paths differ from one another by about 0.2 nanoseconds, so as to define a 5 gigahertz pulse train at the second nodal point.

15   16. The system according to claim 15, wherein time quantification of the optical path length is defined by the distance required for a pulse to travel at the speed of light for a given time interval.

20   17. In an optoelectronic timing system, an adaptive frequency generator system comprising:
        at least one semiconductor laser configured to issue subnanosecond optical pulses defining a periodic pulse train;
25   a multiplicity of optical waveguides, the waveguides configured to have physical lengths differing from one another by a numerical relationship, each length defining a time-quantifiable optical path for a pulse of the train based upon the time required for a pulse to travel a
30 particular length at the speed of light;

a first nodal point coupled to the multiplicity of optical waveguides at which pulses of the train are directed into the multiplicity of optical waveguides;

a second nodal point coupled to the multiplicity of optical waveguides at which pulses directed into the multiplicity of optical waveguides are recombined; and

wherein, the periodicity of pulses recombined at the second nodal point has the same numerical relationship with the periodicity of the issued pulse train as the numerical relationship of the multiplicity of optical waveguides.

18. The system according to claim 17, further comprising:

a pulse detector;

a regenerator coupled to the pulse detector and semiconductor laser;

a regeneration waveguide having a length equal to the longest length of the multiplicity and coupled to receive pulses from the laser, the regeneration waveguide not coupled to the first or second nodal points; and

wherein, a pulse traveling the regeneration waveguide directed to the pulse detector and regenerator so as to trigger the laser to issue a next pulse, the physical length of the regeneration waveguide defining a fundamental frequency of the system.

19. The system according to claim 18, wherein the fundamental frequency of the system is an integer.

20. The system according to claim 19, wherein the periodicity of pulses recombined at the second nodal point defines a frequency which is a multiple of the fundamental

frequency of the system, the numerical value of the multiple being equal to the number of the multiplicity of optical waveguides.